Physics 1

units (وحدات)

Ch.1 : Fundmentals quantites (الكميات الأساسية)

- Length [m]
- Mass [Kg]
- Time [s]

M.K.S

International fundmental unit

SIU → Standerd International Unit

Drived quantites

1) Area [m^2] مساحة

2) Volume [m^3] حجم

3) Velocity (sPeed) السرعة $= \frac{\text{distance}}{\text{time}} = \frac{m}{s}$ (مسافة)

4) Acceleration العجلة $= \frac{\text{Velocity}}{\text{time}} = m/s^2 = m.s^{-2}$

5) (Acceleration due to gravity) عجلة الجاذبية الأرضية

$g = 980\ cm/s^2 \simeq 1000\ cm/s^2$

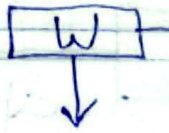
$g = 9.8\ m/s^2 \simeq 10\ m/s^2$

6) $F = m.a$ $[Kg.m/s^2]$ $[N]$

F: قوة "N" — m: mass — a: acceleration

7) $W = m \times g$ $[Kg.m/s^2]$ $g = 10\ m/s^2$

W: Weight قوة جذب الأرض — m: mass — g: gravity



كثافة ρ

8) Density $= \frac{\text{mass}}{\text{Volume}} = \frac{Kg}{m^3} = Kg.m^{-3}$

Density of Water

$\rho_w = 1000\ Kg/m^3$

9) Work (Energy) $= F \times d$ $(N.m) = (Joule)$

Any object has mass [Kg] كل جسم له كتلة

When it move with [Velocity] (m/s).

10) Kinetic Energy (K.E) $= \left[\frac{1}{2}mV^2\right]$ (Joule)

Ex: A 5kg object move with Velocity 4m/s

Calculate "K.E" =

11) $\left[K.E = \frac{1}{2}mV^2 = \frac{1}{2} \times 5 \times (4)^2 = 40J\right]$

12) Momentum $P = \underset{[Kg]}{m} \times \underset{[m/s]}{V}$ $(Kg.m/s)$

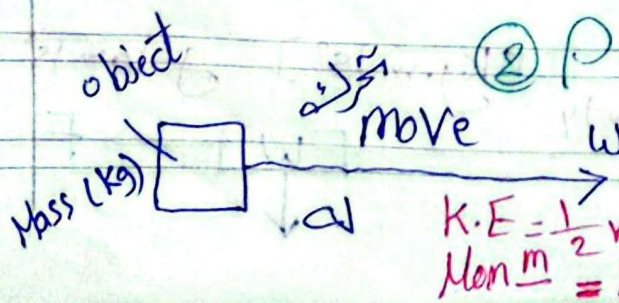
P: Momentum, m: mass, V: velocity

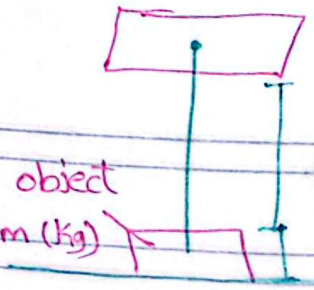
Ex: 8kg object move with Velocity 5m/s

a) calculte ① $K.E = \frac{1}{2}mV^2$

$\frac{1}{2} \times 8 \times (5)^2 = 100J$

② $P = m \times V = 8 \times 5 = 40\ Kg\frac{m}{s}$





الوضع طاقة

Potential Energy ← تم تخزين كمية من الطاقة داخل الجسم تسمى

$P.E = m \cdot g \cdot h$

mass, gravity = $10 m/s^2$, height

Ex// An object of mass 7kg at height 20m

Calculate it's Potential Energy = m.g.h

$P.E = 7 \times 10 \times 20 = 1400 J$

(13) Power = $\frac{\text{work}}{\text{time}} = \frac{\text{Joule}}{\text{time}}$ Watt

(14) Pressure = $\frac{\text{Force}}{\text{Area}} = \frac{N}{m^2}$ (Pascal Pa)

α Alpha, β Beta, γ Gamma, θ Seta, ω Meow, σ Sigma, λ Lambda

ρ row, ϕ فاي, η eta

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$Gm = 10^{9}\ m$

$Mm = 10^{6}\ m$

$Km = 10^{3}\ m$

m

$mH = 10^{-3}\ m$

$\mu H = 10^{-6}\ m$

$nH = 10^{-9}\ m$

$PH = 10^{-12}$

$FH = 10^{-15}$

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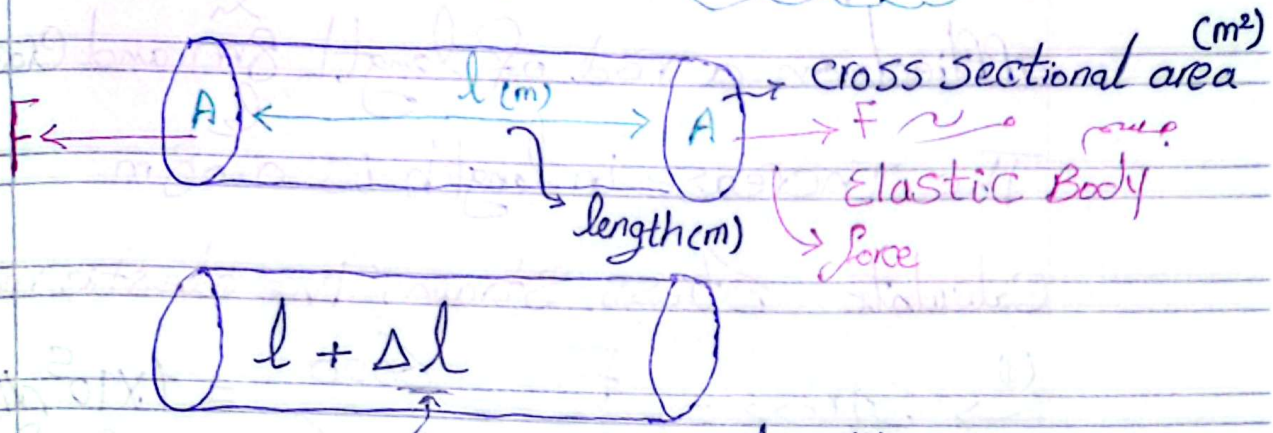
Ch.2 Elasticity المرونة



$$\text{Stress (الجهد)} = \frac{\text{Force}}{\text{Area}} = \frac{N}{m^2}$$

$$\text{Strain (الانفعال)} = \left(\frac{\Delta l}{l}\right) \rightarrow \text{unitless (مالوش وحدة)}$$

Hook's law

For any elestic body

↓↑ Stress ∝ Strain ↑↓

Stress = Constant × Strain

Stress = Elastic modules (معامل مرونة) × Strain

$$\text{Elastic modules} = \frac{\text{Stress}}{\text{Strain}} = \frac{N/m^2}{\text{(مالوش)}}$$

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Ex: 2 equal and opposite forces each of 6000 N applied on a rod of length 8m and cross-sectional area = 0.06 m² The Increase in length is 0.08 m

Calculate Stress, Strain, The elestic modules

(1) → Stress = $\frac{F}{A} = \frac{6000}{0.06} = 1 \times 10^5$ N/m²

(2) → Strain = $\frac{\Delta l}{l} = \frac{l_2 - l_1}{l} = \frac{0.08}{8} = 0.01$

(3) → Elestic modules = $\frac{\text{stress}}{\text{Strain}} = \frac{1 \times 10^5}{0.01} = 1 \times 10^7$ N/m²

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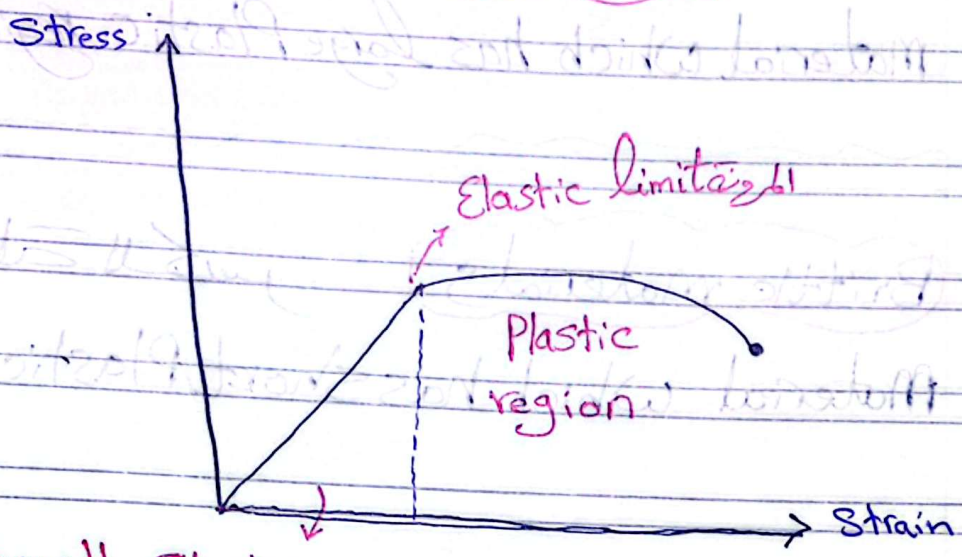
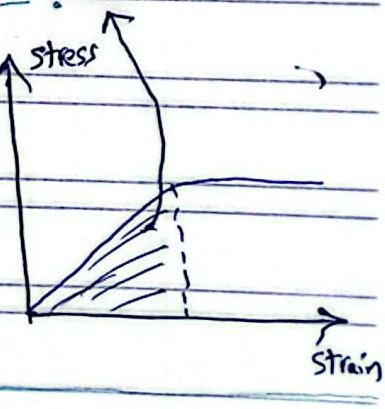
Stress - Strain Curve



المرونة Elastic region الى

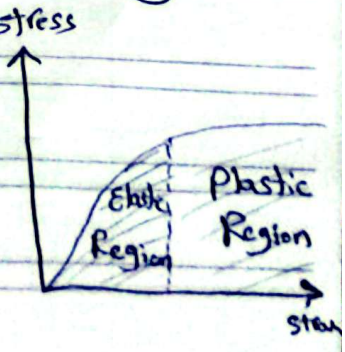
Resilience قابلية الجسم للرجوع للأصل

Is the area under Elastic region



Toughness الصلابة

Is the area under Elastic and Plastic Region



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Ductile Materials قابلية المادة للمد الاستطالة

Material which has large Plastic region (metals)

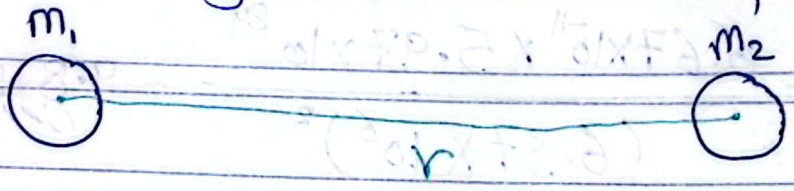
Brittle Materials المواد القابلة للكسر

Material which has short Plastic Region (glass)

Physics

Ch.4

universal gravitation "الجذب العام"



$$F = G\frac{m_1 m_2}{r^2}$$ (Kg, m)

$$F \propto \frac{1}{r^2}$$

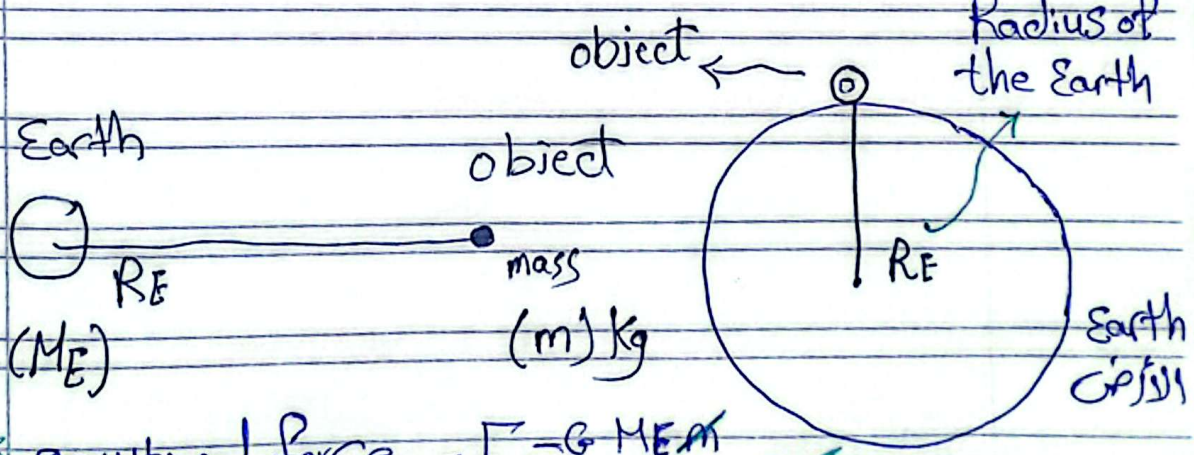
F: general gravitational force

G: 6.67×10^{-11} universal gravitational force constant $N.m^2/Kg^2$

متبادلة

gravitational force is **mutual force**

→ Assert the Inverse square law



gravitational force $= F = \frac{-G M_E m}{r^2} = m \cdot g$

mass of the Earth

$F = m \cdot g$

$$g = \frac{-G M_E}{R_E^2}$$

g: عجلة الجاذبية

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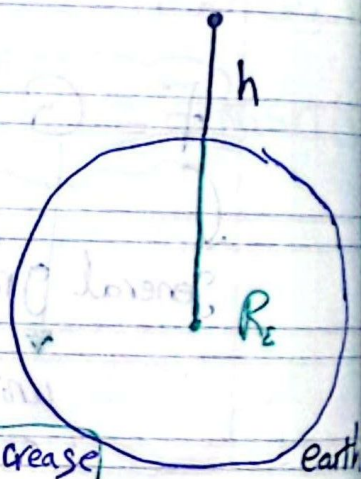
عجلة جاذبية الأرض ←

$$g = G\frac{M_E}{R_E^2}$$

$$g = \frac{6.67\times10^{-11} \times 5.97\times10^{24}}{(6.37\times10^{6})^2} = 9.8\ m/s^2$$

يكون
على سطح الأرض

$$g = G\frac{M_E}{(R_E + h)^2}$$



Gravity [decrease] as the height [increase]

earth

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Physics

$F = G \frac{m_1 m_2}{r^2}$ ← Gravitational force

$F \propto \frac{1}{r^2}$

"obey's the inverse square law."

Ch.3

Solid materials

→ have a definite shape and volume

liquad materials

→ have a definite volume, but don't have definite shape.

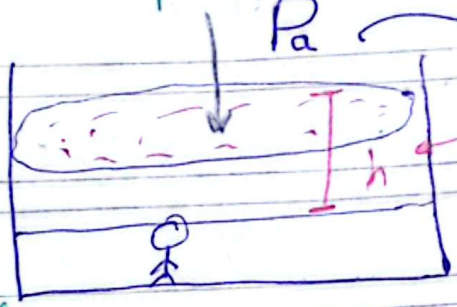
gaseas materials

→ Neither shape nor volume.

رابع ← Fluids

- liquad
- gases

Hydrostatic : Study fluid at rest السوائل عند السكون



الضغط المطلق
Absolute Pressure

$$\text{Total Pressure} = P_a + \rho g h$$

الضغط الجوي

gravity = 10 m/s²

$$P_{total} = P_a + \rho g h \rightarrow \text{depth}$$

$P_a \rightarrow 10^5 \ N/m^2$

$\rho \rightarrow$ density of liquid

Ex:

Calculate the total Pressure in an ocean at depth 70 m.

$$P_{total} = P_a + \rho g h = 10^5 + (1000 \times 10 \times 70)$$

$$= 800,000 \ N/m^2$$

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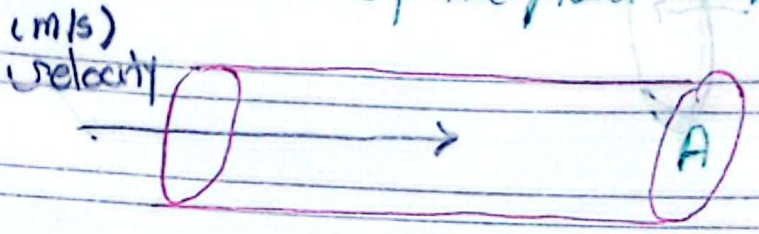
Hydrodynamics : Study the fluid in motion.



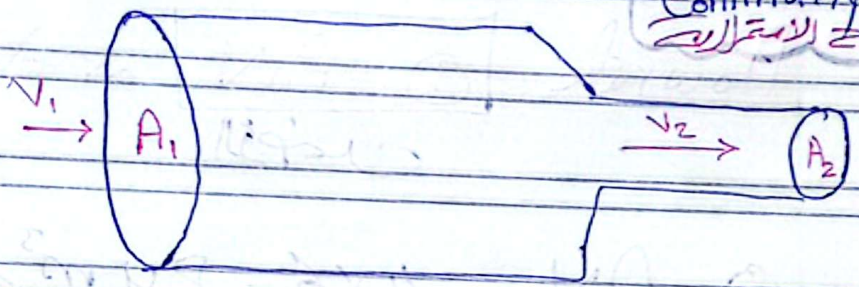
Flow rate

Volume of liquad flow in one second

$$Q = \text{Flow rate} = \frac{\text{Volume}}{\text{time}} = \frac{m^3}{s} = m^3 \cdot s^{-1}$$

$$Q = AV$$

Continuity Equation

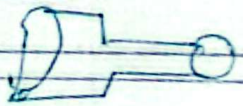


$Q = A_1 V_1$ الداخل

$Q = A_2 V_2$ الخارج

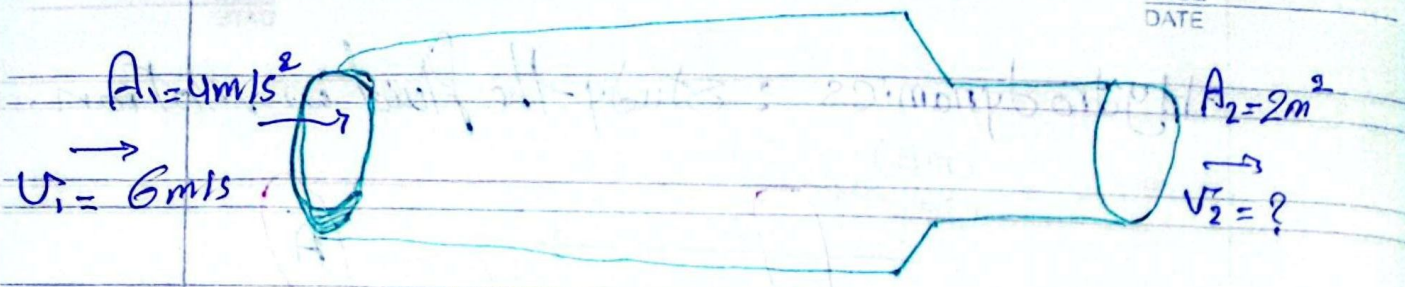
$$A_1 V_1 = A_2 V_2$$

Eg: A Pipline $4m^2$ in area flowing full water has Construction of $2m^2$



If the Velocity in $4m^2$ area is 6m/s

Calculate the Velocity at Constraction and the Flowrate.



$$Q = A_1 V_1 = A_2 V_2$$

$$A_2 V_2 = A_1 V_1$$

$$V_2 = \frac{A_1 V_1}{A_2} = \frac{4 \times 6}{2} = 12 \, m/s$$

Flowrate $\boxed{Q = A_1 V_1}$ or $A_2 V_2$

التدفق

$$Q = A_1 V_1 = 4 \times 6 = 24 \, m^3/s$$